Differentiating the Effects of the Subprime Mortgage Boom and Bust on Naturalized Immigrants, Non-naturalized Immigrants and Native Citizens in the United States.

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February 17, 2010

Abstract

In this paper we explore the effects of the subprime mortgage boom from 2001 to 2005 and the subprime mortgage bust from 2005 to 2008 on the probability of homeownership of naturalized immigrant, non-naturalized immigrant and native US citizen households. Consistent with our predictions, we find that from 2001 to 2005 naturalized and non-naturalized immigrant households increased their probability of homeownership relative to natives by 3.8% and 5.3%, respectively. Then from 2005 to 2008 naturalized and non-naturalized immigrant households decreased their probability of homeownership relative to natives by 1.3% and 1.5%, respectively. Additionally, we find that continent of birth and whether the head of household is self-employed are important predictors of homeownership for immigrants.

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1 Introduction

Homeownership is one of the primary ways that American families build wealth [Chomsisengphet and Pennington-Cross, 2006]. It is also a central component of achieving the 'American Dream' for immigrants living in the United States. It provides families with stability and a connection to their neighbors and local community. US homeownership rates grew to historically high levels during the 1990s, due to a combination of factors including a good economic climate, government initiatives, and new loan underwriting practices [Quercia et al., 2003]. However, during this time the "homeownership gap," the difference between the homeownership rates of native US citizens and immigrants, widened significantly [Borjas, 2002].

The late-1990s and early-2000s also saw the rise of subprime lending practices, which allow households that otherwise would not qualify for a prime home mortgage to be able to own a home [Foote et al., 2008]. In fact, most subprime lending has been concentrated in minority and low-income areas [Calem et al., 2004]. The subprime lending market peaked in 2005, and has been in decline since then as a nationwide drop in housing prices has lead to a wave of foreclosures that hit subprime borrowers especially hard [Mayer and Pence, 2008].

In this paper we set out to differentiate effects of the subprime boom of the early-2000s and subsequent bust of the late-2000s on native US citizens, naturalized immigrants and non-naturalized immigrants. As subprime loans do not have as strict downpayment and income documentation requirements as prime loans, we expect, in line with the previous literature, that the subprime boom and bust will impact non-naturalized immigrants the most. Our analysis shows that during the subprime boom time of 2001 to 2005, naturalized immigrants and non-naturalized immigrants increased their probability of homeownership relative to natives by 3.8% and 5.3%, respectively. Then during the bust period of 2005 to 2008, both naturalized and non-naturalized immigrants decreased their probability of homeownership relative to natives by 1.3% and 1.5%, respectively. We also found that the probability of homeownership of immigrants is significantly affected by their continent of birth and whether they are self-employed or wage workers.

The rest of this paper is presented as follows: Section 2 provides a review of previous literature,

Section 3 describes the data used, Section 4 explains our methodology and hypotheses, Section 5 explains our empirical analysis and results, Section 6 has our conclusions and Section 7 presents our references.

2 Literature Review

The literature review is divided into 3 topics: immigrant assimilation theory and evidence, homeownership theory and subprime lending in the US.

2.1 Assimilation Theory and Evidence

Assimilation theory describes the theoretical pathways through which immigrants might assimilate into their new country. Homeownership can be used as a proxy for the assimilation status of an immigrant into society [Haan, 2007]. Three theoretical assimilation pathways have been proposed by Haan [2007]. The first, *straight-line assimilation*, implies a gradual rise in immigrant homeownership rates to the level of native cohorts over time. The second, *assimilation into a marginal underclass*, implies depressed homeownership rates relative to natives in the long run. The third, *staying in an 'ethnic enclave,'* implies that the homeownership rate of immigrants will vary by community and not depend on the amount of time spent in the new country. It has also been found that location choices and the national origin mix of immigrants influence their assimilation pathway, and thus their homeownership rates [Borjas, 2002].

Using the Myers and Lee [1996] 'double cohort' method of tracking immigrant cohorts by their calendar year of arrival and age at arrival, Borjas [2002] provides evidence that straight-line assimilation effects do exist, that is, homeownership rates for each cohort increase as their time spent in the US increases. In line with Haan's second pathway, Borjas offers evidence that the national origin of immigrants affects their homeownership rate. Since certain immigrant groups have different skill levels, one would expect them to attain different levels of homeownership. Borjas [2002] confirms that this is true as, for example, even after controlling for years in the country, in 1990

the homeownership rate of Canadian immigrants was more than fifty percentage points higher than that of Dominican immigrants. Lastly, Borjas finds that the location choices of immigrants affect their homeownership rates, in accordance with Haan's 'ethnic enclave' theory. Borjas found that one reason why recent immigrants tend to have lower homeownership rates is that they tend to live in large cities that have low overall homeownership levels, such as New York and Los Angeles.

It is important to mention that while all three assimilation pathways appear to exist in the United States, the same is not necessarily true for other countries. For example, in Germany there is evidence that straight-line assimilation does not occur and that the region of origin of an immigrant does not significantly affect their homeownership rate [Sinning, 2006]. The only apparent assimilation pathway in Germany is assimilation into a marginal underclass, as immigrant households in Germany are less likely to own their primary residence than comparable native households [Sinning, 2006].

It is also important to note that Haan [2007], Borjas [2002] and Sinning [2006] do not distinguish between naturalized and non-naturalized immigrants. In their analyses, naturalized immigrants, legal permanent residents, and temporary visa holders are all considered to be the same. A study by McConnell and Marcelli [2007] looks at the effect of the legal status of Mexican immigrants in Los Angeles on assimilation, symbolized by homeownership. They find no significant difference in homeownership rates among naturalized immigrants, legal permanent residents, nonimmigrant visa holders and unauthorized immigrants and speculate that this is due to the rise of subprime lending and more flexible loan underwriting rules.

2.2 Homeownership Theory

In the previous section we have described the pathways by which immigrants may assimilate into society on aggregate. In this section we describe the specific factors that determine homeownership at an individual level. These factors can be separated into three categories: economic, life-cycle and social capital factors.

The economic characteristics of a family and of the area in which they live affect whether they

can afford to own a home. More specifically, the probability of homeownership can be thought of as a function of household income and wealth, the relative cost of owning versus renting in a given area and the income and downpayment constraints imposed by mortgage lenders [Quercia et al., 2003]. Of these, the downpayment constraint has the largest negative effect on homeownership, implying that household wealth is a better indicator of homeownership than household income [Quercia et al., 2003].

Alternatively, the life-cycle theory of homeownership states that the probability of owning a home is a function of family characteristics that change over time. Life events, such as getting married, having children and retiring, influence the decision of owning a home [McConnell and Marcelli, 2007]. An 'ideal' housing career can be broken down into five phases: pre-child, childbearing, child-rearing and launching, post-child, and retired life [Haan, 2005]. In general, as families move from the first through fourth phase their probability of owning a home increases, and as they enter the last phase it decreases [Haan, 2005].

The social capital theory of homeownership proposes that strong social networks in an area increase the flow of information about housing opportunities and lower barriers to homeownership. This process is especially important for immigrants. In fact, English proficiency, time in the country and civic involvement all have a significant impact on the homeownership rates of immigrants [McConnell and Marcelli, 2007].

So, in order to accurately predict whether a household will own their home, economic, life-cycle and social capital characteristics must be taken into account.

2.3 Subprime Lending in the US

Subprime lending began in the late 1980s and grew rapidly in the 1990s and 2000s. Three separate acts of Congress created the legal conditions necessary for the growth of subprime lending. The first, the Depository Institutions Deregulation and Monetary Control Act (DIDMCA) of 1980, allowed lenders to charge high rates and fees to borrowers. The second, the Alternative Mortgage Transaction Parity Act (AMTPA) of 1982, permitted the use of variable interest rates. Third,

the Tax Reform Act (TRA) of 1986, prohibited tax deductions on consumer loans but allowed tax deductions on mortgages on a primary residence [Chomsisengphet and Pennington-Cross, 2006]. The first two acts allowed for the creation of subprime mortgage loans while the third provided an incentive for their proliferation. Subprime mortgages were part of a wave of financial innovation that were supposed to make homeownership more accessible by allowing buyers with lower credit scores, smaller down payments or little documentation of income to get mortgages [Mayer and Pence, 2008].

Subprime lending can be divided into two distinct time periods. From 1995-1999 subprime lending exhibited rapid growth, mostly in the riskiest segments of the mortgage market. From 2000-2004, volume grew rapidly in the least risky segment, with much of it securitized because mortgage-backed securities (with subprime loans as collateral) became attractive to investors [Chomsisengphet and Pennington-Cross, 2006].

As there is no precise definition for what constitutes a subprime loan, three proxies are used to count subprime loans, depending on the data available. Subprime loans are defined as those in securitized pools marked as subprime, those with high interest rates, or those that originate with lenders that specialize in subprime lending [Mayer and Pence, 2008]. Subprime loans are characterized by higher interest rates and fees to compensate for the poor credit history of the borrower and low downpayments. Even borrowers with a high credit score may have trouble getting a prime loan because of high loan-to-value or debt-to-income ratios or lack of documentation of income and assets [Foote et al., 2008]. Lack of income documentation is especially a concern for recent immigrants, unauthorized immigrants and those who are not fluent in English [McConnell and Marcelli, 2007]. According to the Mortgage Bankers Association of America, in the third quarter of 2002 delinquency of subprime mortgages was 5.5 times higher than prime mortgages (14.28% versus 2.54%) and the foreclosure rate of subprime mortgages was 10 times higher than prime mortgages (2.08% versus 0.2%) [Chomsisengphet and Pennington-Cross, 2006]. Additionally, mortgages with high loan-to-value ratios (meaning a low downpayment) are most likely to default [Foote et al., 2008].

While data on subprime lending is scarce, some trends have been uncovered by Mayer and Pence [2008]. First, subprime originations have only a partial correlation with housing price appreciation. While levels of subprime origination are high in Florida and California, which have had high housing price appreciation, levels are low in the New York and Boston areas, which have also had high housing price appreciation [Mayer and Pence, 2008]. Second, subprime originations are not only common in the inner city, which has high densities of low income families, but also in metro outskirts, due to new construction (a trend that has been especially prevalent in the Atlanta area). While regression analysis finds that subprime originations and new construction are significantly correlated, the direction of causation is unknown [Mayer and Pence, 2008]. Third, subprime mortgages are concentrated in zip codes with high proportions of black and Hispanic families, even after controlling for income and credit score. Fourth, subprime originations are concentrated in zip codes with more mid-level credit scores and high unemployment rates, implying that subprime loans do provide mortgages to those families unable to get a traditional mortgage loan [Mayer and Pence, 2008]. Lastly, subprime originations as a share of total housing units is highest in 'hot' housing markets, like Arizona, Nevada, California and Florida, while subprime originations as a share of all originations is highest in depressed housing markets in the Midwest [Mayer and Pence, 2008].

3 Data and Descriptive Statistics

3.1 Data

For our analysis we used the American Community Survey (ACS) microdata set from IPUMS-USA, the Integrated Public Use Microdata series provided by the Minnesota Population Center. The ACS is a yearly survey of 1% of the US population that contains detailed information on a household's income, mortgage payments, citizenship status, birthplace and other demographic characteristics. To eliminate biased results we only use data for individuals denoted as the head of household. We use data from the years 2001, 2005, 2007 and 2008. The year 2001 corresponds with the acceleration of the subprime boom, the year 2005 corresponds with the height of subprime peak, and the years 2007 and 2008 correspond with the subprime bust. Summary statistics for this data are shown in

Table 1: Summary Statistics of ACS Data

Variable	Obs	Mean	Max	Min
owner	2.83M	0.73	0	1
naturalized	2.69M	0.06	0	1
non-natur	2.66M	0.05	0	1
year	2.83M	2005.6	2001	2008
self-employed	2.18M	0.13	0	1
employed	2.83M	0.64	0	1
ln(income)	2.74M	10.1	-0.3	13.6
English	2.83M	0.99	0	1
married	2.83M	0.55	0	1
divorced	2.83M	0.18	0	1
widowed	2.83M	0.11	0	1
age	2.83M	51.9	15	95
education	2.83M	11.5	1	18
num children	2.83M	0.70	0	9

Table 1.

3.2 Descriptive Statistics

Descriptive statistics for the ACS data set are shown in Table 2. Naturalized immigrants have the highest average family income and highest average home value while non-naturalized immigrants have the lowest average income and US citizens have the lowest average home value. We expect that non-naturalized immigrants have higher home values than US citizens despite their lower income because they tend to live in cities (especially New York and Los Angeles) where homes are generally more expensive than suburban and rural areas [Borjas, 2002].

Descriptive statistics for the ACS data set broken down by continent of birth are shown in Table 3. For all continents, non-naturalized immigrants have lower homeownership rates than their naturalized counterparts. This difference is expected because people that go through the naturalization process likely plan on staying in the US for the long term and so are more likely to buy a home than non-naturalized immigrants who may plan to return to their home country in the near future. Likewise, for most continents there is a significant difference in the income's of naturalized

Table 2: ACS Descriptive Statistics

		Overall	US Citizen	Naturalized	Non-naturalized
income	mean	54042	54068	61200	44651
	median	39188	39540	43445	30753
	num	2.8M	2.5M	170K	135K
value of home	mean	237524	228260	357313	283054
	median	162500	162500	275000	225000
	num	2.07M	1.89M	123K	60K
mortgage payment 1	mean	1098	1059	1484	1382
	median	901	866	1222	1214
	num	1.34M	1.2M	86K	47K
mortgage payment 2	mean	410	397	564	502
	median	304	304	405	357
	num	350K	320K	22K	10K

and non-naturalized immigrants. This difference likely reflects the different skills and motivations of each class of immigrants. For Central America, South America, Asia and Africa, naturalized immigrants have higher incomes than non-naturalized immigrants while for North America, Europe and Australia, non-naturalized immigrants have higher incomes. For the latter group, the higher income for non-naturalized immigrants is likely driven by professionals who come to the US for high-paying jobs but still maintain strong ties with their home countries and thus do not go through the naturalization process.

Additionally, for most continents there is a significant difference in the mortgage payment/home value ratio and the mortgage payment/income ratio. The mortgage payment/home value ratio gives the median yearly mortgage payment divided by the median home value for each group. For every continent, this ratio is higher for non-naturalized immigrants than naturalized immigrants, reflecting the fact that non-naturalized immigrants pay a mortgage premium compared to citizens because lending institutions generally have less information about them. The higher ratio could also mean that immigrants are more likely to take out subprime mortgages, which are more expensive than prime mortgages.

In Table 4 we present descriptive statistics broken down between self-employed workers and wage workers. We made this distinction because we expect that self-employed workers may be better off than wage workers in general, but are also more exposed to economic downturns because their

Table 3: ACS Descriptive Statistics by Continent of Birth

		income	home value	mort1	mort2	mort/HV	mort/inc	num	HO rate
US born		39,540	162,500	866	304	8.6%	36%	2,513,112	76%
US terr		69,206	575,000	3,196	1,124	9.0%	75%	93	31%
N Amer	nat	42,030	225,000	1,113	306	7.6%	41%	6,017	81%
	res	50,410	225,000	1,214	306	8.1%	36%	5,310	69%
C Amer	nat	35,625	225,000	1,113	384	8.0%	50%	51,406	68%
	res	24,410	162,500	992	374	10.1%	67%	66,791	41%
S Amer	nat	43,445	350,000	1,324	374	5.8%	47%	10,138	69%
	res	32,760	275,000	1,416	364	7.8%	65%	8,667	41%
Europe	nat	39,880	275,000	1,121	364	6.5%	45%	39,264	78%
	res	43,445	275,000	1,222	326	6.8%	43%	18,948	57%
Asia	nat	57,100	350,000	1,517	448	6.7%	41%	55,244	75%
	res	43,445	275,000	1,426	387	7.9%	50%	29,253	41%
Africa	nat	48,815	275,000	1,417	404	7.9%	45%	5,285	64%
	res	29,545	225,000	1,324	357	9.0%	68%	5,094	31%
Austr	nat	55,325	350,000	1,417	405	6.2%	40%	601	80%
	res	57,520	350,000	1,517	404	6.6%	40%	939	53%

Table 4: Differences between self employed and wage workers

		US Born		Naturalized		Non-Citizen	
		self	wage	self	wage	self	wage
	HO rate	85%	73%	83%	73%	57%	49%
income	mean	58600	45870	64130	48700	46080	41000
	median	33520	35670	35310	36370	26070	27350
	num	212K	1.2M	17K	81K	8K	44K
value of home	mean	309900	225320	447535	345000	353560	275400
	median	225000	162500	350000	275000	275000	225000
mort payment 1	mean	1313	1053	1815	1460	1590	1365
	median	1019	880	1518	1315	1325	1215
	num	143K	940K	13K	65K	6K	38K
mort payment 2	mean	501	397	700	535	590	485
	median	354	303	480	400	410	355
	num	41K	320K	4K	17K	2K	8K

income is not as reliable. The data shows that for all classifications, self-employed workers have a higher homeownership rate, higher income, and higher home values.

4 Methodology & Hypotheses

Subprime mortgages were created for people who do not qualify for prime mortgage loans. The main reasons a person may not qualify for a prime loan are 1) poor credit history (or no credit history), 2) lack of documentation of income or assets, or 3) small downpayment. We expect that immigrants, and especially non-naturalized immigrants, will face problems 1) & 2) at a higher rate than native US citizens. Thus, we expect that immigrants are more likely to be engaged in subprime lending than native US citizens. Furthermore, we expect non-naturalized immigrants are more likely to be engaged in subprime lending than naturalized immigrants.

The lack of a formal definition of subprime loan makes it hard to track and measure subprime lending. Thus, it is hard to directly determine who has been engaged in subprime lending. Our approach is to measure participation in the subprime market indirectly by conducting a before-and-after analysis of the homeownership gap between native citizens and each class of immigrants (naturalized and non-naturalized). If the homeownership gap between natives and immigrants decreases it provides evidence that immigrants are attaining homeownership at a higher rate than natives, suggesting that immigrants are more active in the subprime mortgage market than natives. On the other hand, if the gap between natives and immigrants increases it provides evidence that immigrants are less active in the mortgage market or that they are losing their homes at a faster rate than natives.

We test our hypotheses using a linear probability model, which is shown in a general form as equation 1. To estimate this model we employ the ordinary least squares (OLS) technique.

$$H_t = \beta_{0,t} + \beta_{1,i,t} N_{i,t} + \beta_{2,i,t}(N_{i,t} * Y) + \beta_{3,k,t} S_k + \beta_{4,t} X_t + \beta_{5,k,t} Z_k + \varepsilon \tag{1}$$

In equation 1, H is a binary variable for homeownership set to 1 for households that own their home

and 0 for those that do not. N is a binary variable representing the immigrant and citizenship status of the household set to 1 for immigrants and 0 for natives, where $i = 1$ for naturalized immigrants and $i = 2$ for non-naturalized immigrants. The variable $(N_{i,t} * Y)$ is an interaction effect between binary variables for immigrant/citizenship status and "after" year (2005 for the boom period and 2008 for the bust period). We use different models for each time period where $t = 1$ represents the boom time (2001-2005) and $t = 2$ represents the bust time (2005-2008).

The S variable is a proxy for the local subprime market, where $k = 1$ represents the subprime "hotbed" dummy variable and $k = 2$ represents the state subprime origination ratio variable. The subprime "hotbed" proxy is a dummy variable representing households that live in metropolitan areas in the five "hotbed" states with the highest number of subprime loans (California, Nevada, Georgia, Florida, Arizona). This variable allows us to separate out those households that were most strongly influenced by the subprime lending market. The second proxy is the ratio of the number of subprime mortgages to total mortgages for each state in the year 2005, as calculated by Mayer and Pence [2008]. While this ratio potentially masks differences in housing markets within states, it does help to differentiate those states that were highly involved in subprime lending and those that were not. It should be noted that our subprime proxies try to capture whether or not living in an area with high levels of subprime lending influences the probability of homeownership of a household. These proxies do not tell us which individual households take out subprime loans and cannot tell us how taking out a subprime loan affects the probability of homeownership of that individual household.

X is a matrix of variables including the head of household's sex, age, marital status, income, employment status, English proficiency, education and the number of children in the household, and Z is a matrix of state dummy variables for $k = 1$ and is not included in the equation for $k = 2$.

The coefficients of interest are β_1, β_2 and β_3. A significant value for $\beta_{1,i,t}$ means that there is a difference in the probability of homeownership between native citizens and the set of immigrants i at the start of time period t. We expect this coefficient to be negative, meaning that there exists a "homeownership gap" (i.e., immigrants have a lower probability of homeownership than natives).

A significant value for $\beta_{2,i,t}$ means that there is a change in the "homeownership gap" between native citizens and the set of immigrants i by the end of period t. We expect this coefficient to be positive when $t = 1$ (the boom time) because the availability of subprime loans helped immigrants who previously were not eligible for a prime loan to be able to afford to own a home. We expect it to be negative when $t = 2$ (the bust time) because households with subprime loans were especially vulnerable to losing their home during the economic downturn and we believe the relative number of immigrants with subprime loans is higher than the number of natives with subprime loans. We also expect that the magnitude of the coefficient will be larger for $i = 2$ (non-naturalized immigrants) than for $i = 1$ (naturalized immigrants) because they had more to gain during the boom, because of documentation problems, and more to lose during the bust, because they may have less resources to rely on.

While most of our analysis focuses on differences between naturalized and non-naturalized immigrants, we also look at differences between immigrants based on birthplace. Immigrants are divided by continent of birth to examine how birth continent affects homeownership outcomes. We also include immigrants from US territories in this analysis. Though technically citizens of the US, people from the US territories are still different from native US citizens and behave like immigrants. The model we use for this analysis is shown as equation 2.

$$Prob(H_t = 1) = \Phi(\alpha_{0,t} + \sum_{l} \alpha_{1,l,t} R_{l,t} + \alpha_{2,t} S + \alpha_{3,t} X_t) \tag{2}$$

In equation 2, $R_{l,t}$'s are the set of dummy variables for each continent of birth where $R_1 \sim$ US Territories, $R_2 \sim$ North America, $R_3 \sim$ Central America, $R_4 \sim$ South America, $R_5 \sim$ Europe, $R_6 \sim$ Asia, $R_7 \sim$ Africa, $R_8 \sim$ Australia. The base group that these immigrant groups are compared to is native US citizens. Additionally, S is the subprime "hotbed" proxy variable and X_t is a matrix of variables including the head of household's employment status, income, marital status, English proficiency, age, education level and number of children in the household. The model is run four times, where $t = 1$ refers to 2001, $t = 2$ refers to 2005, $t = 3$ refers to 2007 and $t = 4$ refers to 2008.

Equation 2 is estimated as a probit regression, with the coefficients representing the marginal

effects from the probit estimation. These effects represent the marginal impact of an infinitesimal change in each independent continuous variable on the probability of homeownership, providing z straight forward interpretation of estimated results from the probit models. For the birthplace dummy variables, the coefficient estimates can be interpreted as the change in the probability of homeownership for a particular immigrant group relative to natives.

By executing the model separately for each year, we can track how the coefficients of interest, the $\alpha_{1,l,t}$'s, change over time. We expect that the coefficients will be negative for all immigrant groups for all years, reflecting the "homeownership gap," and that the magnitude of the coefficients should decrease during the boom time (2001 to 2005) and increase during the bust time (2005 to 2007/2008), for the reasons explained above. We also expect the magnitude of the coefficients will vary significantly by continent of birth. Based on previous literature, immigrants from the US territories and Africa are expected to have the largest homeownership gap.

Lastly, we investigate the differing impact of the subprime mortgage market on wage workers and self-employed workers. For this analysis we use a linear probability model estimated using OLS, shown as equation 3.

$$H_t = \gamma_{0,t} + \gamma_{1,t}F_t + \gamma_{2,t}X_t + \gamma_{3,t}Z + \varepsilon \tag{3}$$

In the equation, F_t is a binary variable for self-employment set to 1 for self-employed workers and 0 for wage workers, X_t is a matrix of variables including the head of household's employment status, income, marital status, English proficiency, age, education level and number of children in the household and Z is a matrix of state dummy variables. The model is run four times, where $t = 1$ refers to 2001, $t = 2$ refers to 2005, $t = 3$ refers to 2007 and $t = 4$ refers to 2008.

By executing the model seperately for each year, we can track how the coefficients of interest, the $\gamma_{1,t}$'s, change over time. We expect that the coefficients will be positive for all years because self-employed workers are generally better off than wage workers. We also expect that the magnitude of the coefficient will decrease during the bust time (2005-2007/2008) because self-employed workers are more vulnerable to economic downturns because they are heavily invested in service industries

and generally have less reliable sources of income.

5 Empirical Analysis & Results

The results of our before-and-after analysis for 2001 to 2005 is shown in Table 5. Models 1 and 2 look at naturalized immigrants and native citizens while models 3 and 4 look at non-naturalized immigrants and native citizens. Model 1, which uses the subprime dummy variable as a subprime proxy, shows that in 2001 naturalized immigrants had a 4% lower probability of homeownership than natives but that they closed this gap by 2005. The subprime dummy variable also has a negative effect, with households living in subprime hotbeds having a 3% lower probability of homeownership. When the state subprime ratio is used as a proxy, in model 2, the results are similar to model 1 and the subprime effect is still negative. Model 3 shows that in 2001 non-naturalized immigrants had a 24% lower probability of homeownership than native citizens and that they increased their probability of homeownership relative to natives by 5% from 2001 to 2005. The subprime dummy variable had a negative effect of the same magnitude as in model 1. When using the state subprime ratio as a proxy, in model 4, the results are similar to model 3 and the subprime effect is still negative.

Next we present the results from the before-and-after analysis for 2005 to 2008 in Table 6. Models 1 and 2 look at naturalized immigrants and native citizens while models 3 and 4 look at non-naturalized immigrants and native citizens. Model 1 shows that in 2005 the probability of homeownership for naturalized immigrants was not significantly different than that of native citizens but by 2008 the probability of homeownership for naturalized immigrants was 1.3% lower than that of native citizens. The subprime dummy variable again has a negative effect, with households living in subprime hotbeds having a 3.4% lower probability of homeownership. Model 2, which uses the state subprime ratio as the subprime proxy gives slightly different results. It shows that in 2005 naturalized immigrants had a 2.7% lower probability of homeownership than natives and that this gap did not significantly change from 2005 to 2008. The state subprime ratio coefficient is significant, as is the state subprime ratio interacted with the year 2008, showing that households

Table 5: Factors that Influence the Probability of Homeownership from 2001 to 2005

	Naturalized		Non-Naturalized	
	(1)	(2)	(3)	(4)
naturalized	-0.043*	-0.063*		
	(0.003)	(0.003)		
nat*2005	0.038*	0.038*		
	(0.004)	(0.004)		
non-nat			-0.242*	-0.261*
			(0.004)	(0.004)
non-nat*2005			0.053*	0.054*
			(0.004)	(0.004)
state subp ratio		-1.185*		-1.22*
		(0.021)		(0.021)
subp dummy	-0.031*		-0.033*	
	(0.004)		(0.004)	
self	0.045*	0.044*	0.048*	0.047*
	(0.001)	(0.001)	(0.001)	(0.001)
employed	0.021*	0.022*	0.021*	0.022*
	(0.001)	(0.001)	(0.001)	(0.001)
ln(income)	0.072*	0.070*	0.072*	0.071*
	(0.000)	(0.000)	(0.000)	(0.000)
age	0.008*	0.008*	0.008*	0.008*
	(0.000)	(0.000)	(0.000)	(0.000)
English	0.021*	0.156*	0.064*	0.071*
	(0.001)	(0.013)	(0.006)	(0.006)
married	0.285*	0.293*	0.277*	0.285*
	(0.001)	(0.001)	(0.001)	(0.001)
divorced	0.076*	0.081*	0.070*	0.076*
	(0.001)	(0.001)	(0.001)	(0.001)
widowed	0.157*	0.163*	0.147*	0.153*
	(0.002)	(0.002)	(0.002)	(0.002)
num child	0.022*	0.021*	0.024*	0.023*
	(0.000)	(0.001)	(0.000)	(0.000)
education	0.009*	0.008*	0.008*	0.007*
	(0.000)	(0.000)	(0.000)	(0.000)
intercept	-0.797	-0.772	-.723*	-0.693
	(0.014)	(0.014)	(0.007)	(0.007)
State Dummies	Yes	No	Yes	No

* denotes significance at 1%

Table 6: Factors Influencing the Probability of Homeownership from 2005 to 2008

	Naturalized		Non-Naturalized	
	(1)	(2)	(3)	(4)
naturalized	0.002	-0.027*		
	(0.002)	(0.002)		
nat*2008	-0.013*	0.005		
	(0.002)	(0.003)		
non-nat			-0.183*	-0.209*
			(0.002)	(0.002)
non-nat*2008			-0.015*	0.002
			(0.003)	(0.003)
state subp ratio		-1.179*		-1.22*
		(0.019)		(0.019)
subp ratio*2008		-0.346*		-0.352*
		(0.015)		(0.015)
subp dummy	-0.034*		-0.036*	
	(0.003)		(0.003)	
self	0.046*	0.045*	0.049*	0.048*
	(0.001)	(0.001)	(0.001)	(0.001)
employed	0.020*	0.022*	0.020*	0.023*
	(0.001)	(0.001)	(0.001)	(0.001)
ln(income)	0.072*	0.071*	0.073*	0.071*
	(0.000)	(0.000)	(0.000)	(0.000)
age	0.008*	0.008*	0.008*	0.008*
	(0.000)	(0.000)	(0.000)	(0.000)
English	0.123*	0.135*	0.051*	0.059*
	(0.011)	(0.013)	(0.005)	(0.004)
married	0.280*	0.287*	0.272*	0.279*
	(0.001)	(0.001)	(0.001)	(0.001)
divorced	0.072*	0.076*	0.066*	0.070*
	(0.001)	(0.001)	(0.001)	(0.001)
widowed	0.153*	0.158*	0.143*	0.148*
	(0.002)	(0.001)	(0.002)	(0.002)
num child	0.019*	0.018*	0.022*	0.021*
	(0.000)	(0.001)	(0.000)	(0.000)
education	0.010*	0.009*	0.009*	0.008*
	(0.000)	(0.000)	(0.000)	(0.000)
intercept	-0.790*	-0.757*	-0.727*	-0.687
	(0.011)	(0.011)	(0.006)	(0.006)
State Dummies	Yes	No	Yes	No

* denotes significance at 1%

living in areas with high levels of subprime lending in 2005 have a significantly lower probability of homeownership in 2008.

Model 3 shows that in 2005 the probability of homeownership for non-naturalized immigrants was 18.3% lower than natives and that by 2008 the gap between non-naturalized immigrants and natives increased by 1.5%. Again, the subprime dummy variable has a negative effect, with households living in subprime hotbeds having a 3.6% lower probability of homeownership. Model 4, which uses the state subprime ratio as the subprime proxy gives similar results. It shows that non-naturalized immigrants have a 20.9% lower probability of homeownership in 2005 and this gap did not significantly change from 2005 to 2008. Additionally, the state subprime ratio coefficient is significant, as is the state subprime ratio interacted with the year 2008, showing that households living in areas with high levels of subprime lending in 2005 have a significantly lower probability of homeownership in 2008.

The other variables act in the direction we would expect. The coefficients for the employed dummy variable, self-employed dummy variable and for ln(income) are all positive and significant in all models. The coefficients for the English proficiency dummy variable, age variable, number of children variable, years of education variable and each of the married, divorced and widowed dummy variables are all also positive and significant in all models.

In addition to investigating how the homeownership levels of both classes of immigrants change over time, we also investigated the impact of birthplace and employment status on homeownership and how it varied during the subprime mortgage boom and bust. Table 6 tracks the impact of birthplace on homeownership rate over time for each of the years 2001, 2005, 2007, 2008. For every group the negative effect of birthplace diminishes from 2001 to 2007, meaning that the gap between immigrants and natives decreased over this time, which is in line with our earlier results. For immigrants from North America, Central America, Europe and Asia, the effect then rebounds from 2007 to 2008, meaning that the homeownership gap between immigrants from these areas and natives widened during this time. Meanwhile, for immigrants from South America, Africa and Australia, the effect continues to diminish from 2007 to 2008, meaning that the homeownership gap between

Table 7: Changes in Birthplace Coefficients over Time

	2001	2005	2007	2008
US Territories	-0.239*	-0.200*	-0.159*	-0.159*
	(0.014)	(0.009)	(0.008)	(0.008)
N Amer	-0.081*	-0.051*	-0.049*	-0.056*
	(0.013)	(0.008)	(0.008)	(0.008)
C Amer	-0.172*	-0.119*	-0.104*	-0.106*
	(0.005)	(0.003)	(0.003)	(0.003)
S Amer	-0.217*	-0.175*	-0.159*	-0.156*
	(0.012)	(0.007)	(0.006)	(0.006)
Europe	-0.114*	-0.091*	-0.081*	-0.088*
	(0.006)	(0.004)	(0.004)	(0.004)
Asia	-0.207*	-0.146*	-0.144*	-0.151*
	(0.005)	(0.003)	(0.003)	(0.003)
Africa	-0.358*	-0.287*	-0.271*	-0.262*
	(0.014)	(0.009)	(0.008)	(0.008)
Aust	-0.241*	-0.181*	-0.146*	-0.130*
	(0.035)	(0.023)	(0.022)	(0.022)
subp dummy	-0.047*	-0.059*	-0.067*	-0.072*
	(0.002)	(0.001)	(0.001)	(0.001)
self	0.076*	0.069*	0.075*	0.073*
	(0.002)	(0.001)	(0.001)	(0.001)
employed	0.015*	0.007*	0.009*	0.011*
	(0.002)	(0.001)	(0.001)	(0.002)
ln(income)	0.080*	0.079*	0.078*	0.080*
	(0.001)	(0.001)	(0.001)	(0.001)
married	0.295*	0.266*	0.266*	0.271*
	(0.002)	(0.001)	(0.001)	(0.001)
divorced	0.046*	0.031*	0.032*	0.029*
	(0.002)	(0.001)	(0.001)	(0.001)
widowed	0.093*	0.082*	0.082*	0.082*
	(0.004)	(0.002)	(0.002)	(0.002)
English	0.168*	0.134*	0.156*	0.123*
	(0.015)	(0.007)	(0.007)	(0.007)
age	0.010*	0.008*	0.008*	0.009*
	(0.000)	(0.000)	(0.000)	(0.000)
num child	0.031*	0.022*	0.023*	0.022*
	(0.001)	(0.000)	(0.001)	(0.000)
education	0.007*	0.010*	0.010*	0.011*
	(0.000)	(0.000)	(0.000)	(0.000)

* denotes significance at 1%

Table 8: Changes in Self-Employed Coefficient Over Time

	2001	2005	2007	2008
self	0.051*	0.047*	0.052*	0.050*
	(0.002)	(0.001)	(0.001)	(0.001)
immigrant	-0.127*	-0.193*	-0.083*	-0.188*
	(0.003)	(0.002)	(0.001)	(0.002)
employed	0.022*	0.019*	0.018*	0.025*
	(0.002)	(0.001)	(0.001)	(0.001)
ln(income)	0.072*	0.074*	0.073*	0.072*
	(0.001)	(0.001)	(0.001)	(0.001)
subp dummy	-0.013*	-0.035*	-0.031*	-0.038*
	(0.008)	(0.004)	(0.004)	(0.004)
married	0.289*	0.271*	0.269*	0.272*
	(0.002)	(0.001)	(0.001)	(0.001)
divorced	0.077*	0.068*	0.068*	0.064*
	(0.003)	(0.002)	(0.002)	(0.002)
widowed	0.153*	0.146*	0.145*	0.140*
	(0.004)	(0.003)	(0.002)	(0.003)
age	0.009*	0.008*	0.008*	0.008*
	(0.000)	(0.000)	(0.000)	(0.000)
English	0.156*	0.059*	0.159*	0.042*
	(0.011)	(0.006)	(0.006)	(0.006)
num child	0.030*	0.022*	0.023*	0.021*
	(0.001)	(0.000)	(0.000)	(0.000)
education	0.006*	0.008*	0.009*	0.009*
	(0.000)	(0.000)	(0.000)	(0.000)
intercept	-0.840*	-0.716*	-0.848*	-0.740*
	(0.014)	(0.008)	(0.008)	(0.008)
State Dummies	Yes	Yes	Yes	Yes

* denotes significance at 1%

immigrants from these areas and natives continued to decrease during this time. Additionally, for immigrants from the US territories the effect of birthplace on homeownership does not change from 2007 to 2008.

Last we track how the impact of being self-employed changes over time. Self-employed workers in the US tend to be better off than wage workers; as shown in Table 4 self-employed workers have higher homeownership rates, incomes and home values than wage workers. As shown in Table 8, the positive effect of self-employment on homeownership decreases from 2001 to 2005, then increases again from 2005 to 2007 and then decreases from 2007 to 2008. All these changes are relatively small showing that self-employed workers were not significantly affected by the subprime boom and have not yet been affected by the subprime bust.

6 Inferences & Conclusions

Our analysis enables us to make several inferences about the differing effects of the subprime mortgage boom and bust on naturalized immigrants, non-naturalized immigrants and native citizens.

First, we can infer that both naturalized and non-naturalized immigrants benefited from the subprime mortgage boom from 2001 to 2005. Both groups experienced significant gains in homeownership over this time relative to native citizens. This is in line with our original hypothesis that immigrants will benefit most from the subprime mortgage boom because without subprime loans many immigrants would be unable to afford a home. Additionally, we find evidence that non-naturalized immigrants experienced a bigger gain in homeownership than naturalized immigrants, as expected.

Second, we find evidence that the subprime mortgage bust hurt immigrants more than natives. This evidence is not as strong as that of our previous inference but this is to expected because the subprime bust only began in late 2007 and accelerated in in mid-2008, while our 2008 data is from March 2008. We expected that non-naturalized immigrants would be impacted more than naturalized immigrants, but the evidence suggests that the decrease in relative homeownership was

not significantly different for naturalized and non-naturalized immigrants. We should note that we cannot pinpoint the exact cause of the decrease in the relative homeownership rates of immigrants during the subprime mortgage bust. The decrease is likely attributed to a combination of the tightening of credit markets, preventing new mortgages, and foreclosures, terminating previously existing mortgages.

We can also infer that continent of birth is an important predictor of homeownership for immigrants in the US. We found that immigrants from Africa have the lowest homeownership rates and immigrants from North America (namely Canada) have the highest homeownership rates, though all groups have significantly lower homeownership rates than natives. Additionally, from 2001 to 2005 the negative impact of birthplace decreased for all groups. From 2005 to 2007 the negative impact of birthplace increased for immigrants from North America, Central America, Europe and Asia while the negative effect continued to decrease for immigrants from South America, Africa and Australia. These trends are in line with our other results and provide evidence for our hypotheses.

Overall, our analysis shows that the subprime mortgage boom and bust had a large effect on the housing market, especially for immigrants. During the boom period, both naturalized and non-naturalized immigrants experienced significant gains in homeownership relative to natives. Then during the bust both immigrants groups have experienced significant losses in homeownership relative to natives. The data on the subprime bust is still very preliminary so the fact that it reveals significant losses is telling. We expect that these losses will continue to occur in years to come because of the tightening of credit markets and stricter loan underwriting rules.

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